FORGOING SALT:

POTENTIAL COSTS AND EFFECTS ON STRATEGIC CAPABILITIES

Staff Working Paper

August 1986

The Congress of the United States
Congressional Budget Office

NOTICE

This paper is not available for public release until Monday, August 4, 1986.

J932-31

NOTE

Unless otherwise indicated, all dollar amounts in this report are in fiscal year 1987 dollars.

PREFACE

Some members of the Congress have expressed concern that the recent Administration decision to renounce its "no-undercut" policy regarding the SALT II arms control treaty could fuel an escalation in the arms race. There is great uncertainty about the potential effects, if any, of forgoing SALT. As requested by the House Committee on Armed Services, this preliminary analysis examines the probable bounds, analyzing the effects of both countries continuing with SALT-type restraints, and those of a possible robust expansion of Soviet forces. The report then examines the effects of such changes on the survivability of U.S. forces--particularly land-based forces. In accordance with the Congressional Budget Office (CBO) mandate to provide objective analysis, this report contains no recommendations.

Bonita J. Dombey of CBO's National Security Division prepared the study, under the general supervision of Robert F. Hale and John D. Mayer, Jr. M. Diane Griffith supplied the cost analysis. Bertram D. Braun assisted extensively throughout the study's preparation. Alan Zukerman also provided assistance. Patricia H. Johnston edited the manuscript. G. William Darr prepared the report.

Rudolph G. Penner
Director

August 1986

CONTENTS

		Page
PREFACE		ii
INTRODUCTION AND SUMMARY		1
SECTION I.	TODAY'S BALANCE OF FORCES	4
	Measures Used in This Analysis	4
	Today's Balance	6
SECTION II.	PROJECTIONS UNDER SALT-TYPE CONSTRAINTS	9
	Defining SALT-Type Constraints	9
	Projections	10
SECTION III.	PROJECTIONS WITHOUT SALT-TYPE CONSTRAINTS	14
	Soviet Expansion Without Arms Control Limits	14
	U.S. Responses	17
SECTION IV.	SURVIVABILITY OF U.S. FORCES WITH AND WITHOUT ARMS CONTROL LIMITS	23
	Implications for the SICBM	23
	Effects on Other Land-Based Missiles	29
	Synergism	32
APPENDIX A.	ILLUSTRATIVE SOVIET BALLISTIC MISSILE FORCES WITH SALT-TYPE CONSTRAINTS AND WITH ROBUST EXPANSION	34
APPENDIX B.	ASSUMPTIONS UNDERLYING SOVIET FORCES USED TO ATTACK THE SICBM SYSTEM	39

TABLES

		Page
TABLE 1.	ADDED LIFE-CYCLE COSTS TO MAINTAIN AT LEAST 250 SURVIVING SICBMs UNDER THREE ALTERNATIVES	28
TABLE A-1.	ILLUSTRATIVE SOVIET BALLISTIC MISSILE FORCES WITH SALT-TYPE CONSTRAINTS	35
TABLE A-2.	ILLUSTRATIVE SOVIET BALLISTIC MISSILE FORCES WITH ROBUST EXPANSION	37

FIGURES

		Page
FIGURE 1.	CURRENT U.S. AND SOVIET STRATEGIC FORCES	7
FIGURE 2.	U.S. AND SOVIET STRATEGIC FORCES (With SALT-Type Constraints)	11
FIGURE 3.	RANGE OF POSSIBLE SOVIET STRATEGIC FORCES BY 1996 (Without Arms Control Limits)	16
FIGURE 4.	U.S. AND SOVIET STRATEGIC FORCES, 1990 and 1996 (Without Arms Control Limits)	19
FIGURE 5.	SICBM SURVIVABILITY (Baseline Force: With SALT-Type Constraints Versus Expanded Soviet Force)	25
FIGURE 6.	SURVIVABILITY OF U.S. SMALL ICBM, 1986, 1990, AND 1996 (Soviet Forces Unconstrained by Arms Control Limits)	27
FIGURE 7.	SOVIET WARHEADS NEEDED TO DESTROY 50 PERCENT AND 90 PERCENT OF U.S. BASELINE SICBM FORCE, AS A FUNCTION OF DISPERSAL AREA	30

INTRODUCTION AND SUMMARY

In 1979, the United States and the Soviet Union signed the SALT II treaty to control the number of strategic nuclear weapons that each country could have. 1/ The treaty placed limits both on the number of launchers carrying multiple warhead missiles and on the total number of launchers. The last of the treaty's provisions expired in December 1985.

Since the treaty was not approved by the U.S. Senate, its terms never became binding U.S. policy. Instead, until recently, the Administration pledged not to "undercut" the provisions of the treaty so long as the Soviets followed the same policy. In June 1986, however, President Reagan announced that the United States would no longer be bound by the provisions of SALT II, arguing that the Soviet Union had violated its provisions. The Administration is negotiating with the Soviet Union on other strategic nuclear arms control proposals, including one recently made by the Soviets.

Some Members of the Congress have expressed concern about the U.S. decision to renounce the "no-undercut" policy. Indeed, a recent nonbinding resolution of the House called on the Administration to continue not to undercut SALT II. Concerns are based in part on the possibility that the absence of SALT II restraints could fuel an escalation in the arms race.

Would the absence of arms control limits speed up the arms race? It need not, of course. Both sides could continue along their current paths even without any arms control limits. Indeed, the Administration argues that the current rough balance of forces between the United States and the Soviet Union, coupled with weakness in the Soviet economy, would preclude any major expansion by the USSR.

On the other hand, the Soviet Union has already developed, or is deploying, numerous new strategic weapons systems. Both the Central Intelligence Agency (CIA) and the Department of Defense (DoD) have projected substantial potential for growth in Soviet nuclear weapons in the absence of arms control limits, while also noting that such an expansion would not necessarily be undertaken.

---

1. Note that the major constraints were placed on the number of launchers that could be maintained by each country, not the number of warheads. Numbers of warheads on existing types of missiles, however, were limited to the maximum number that had been tested.

The CIA, for example, recently testified that--in the absence of arms control limits--the Soviet Union could have 21,000 nuclear warheads by the mid-1990s with a robust but not maximum expansion. This would provide it with about 6,800 to 7,400 more warheads than the United States would have without procurement of systems above and beyond current plans. If the United States were to match such an expansion, it would require a huge increase in U.S. forces: for example, adding about 867 more MX missiles in Minuteman silos or 36 more Trident submarines with Trident II missiles or 270 more bombers each carrying 28 weapons. The cost of such an expansion would vary widely but could add tens of billions of dollars to U.S. costs as well as greatly increasing Soviet expenditures.

A Soviet buildup could also threaten the ability of certain U.S. forces --particularly land-based forces--to survive a Soviet attack, a key element of the U.S. strategy for deterring nuclear war. For example, assuming the Administration deploys a baseline force of 500 small intercontinental ballistic missiles (SICBMs), the Congressional Budget Office (CBO) estimates that close to 50 percent of the SICBMs would survive the threat anticipated under SALT-type restraints. That percentage could fall to less than 15 percent by 1996, if the USSR were to enlarge its forces as described above. The survivability of SICBMs could, however, be preserved in several ways--most cheaply by expanding the area over which these mobile missiles are deployed. An expansion of Soviet forces could also have important effects on the ability of other nuclear forces to survive, such as the 50 additional MX missiles that the Administration is currently considering and the bomber force. Submarines at sea are the only systems whose survivability would not be affected by an expanded Soviet force.

This paper, which is a preliminary analysis, addresses these issues, beginning with a discussion of the balance of strategic forces between the United States and Soviet Union and likely trends assuming continuation of SALT-type restraints. 2/ Next the paper turns to possible Soviet force expansion in the absence of arms control limits. Finally, the report discusses possible U.S. responses to any Soviet buildup, focusing on the effects on land-based forces, because they are today the most vulnerable leg of the U.S. triad and because solving their vulnerability has been the most complex and contentious issue of the U.S. strategic modernization effort. 3/

---

2. These subjects will be covered in detail in a forthcoming Congressional Budget Office study.

3. The triad includes three segments of strategic nuclear weapons systems: land-based missiles, missiles launched from nuclear submarines, and missiles or bombs launched from strategic bombers.

Nothing in these discussions should be taken as a CBO forecast of future U.S. or Soviet behavior; that cannot be known. This paper does, however, suggest a range of possible responses in the absence of arms limits.

SECTION I. TODAY'S BALANCE OF FORCES

The balance of strategic weapons inventories can be measured in several ways. Measures of relative size and survivability can also indirectly indicate the relative stability between U.S. and Soviet forces.

MEASURES USED IN THIS ANALYSIS

Three main quantitative measures of effectiveness are used in this analysis.

Total Warheads. This is a measure of general capability against a potential set of targets. This measure includes warheads on all three systems of the U.S. nuclear triad: strategic bombers and land-based and submarine-based missiles.

Hard-Target Warheads. This is a subset of total warheads that measures capability against targets such as ICBM silos, communications facilities, and leadership bunkers that are hardened to withstand nuclear detonations. Because these warheads can attack key targets, they are analyzed separately. 1/ A further subset of hard-target warheads includes those that are deployed in fixed locations, namely, land-based intercontinental ballistic missiles (ICBMs) in silos. These systems are increasingly vulnerable to attack by more accurate weapons and, in the case of a multiple warhead ICBM, provide a favorable ratio of attacking warheads for warheads destroyed. Because this vulnerability could prompt their early use in a crisis, these systems provide one measure for comparing stability of forces in a crisis.

---

1. U.S. hard-target warheads include Minuteman III missiles with Mark 12A warheads, MX missiles, and small ICBM land-based missiles; Trident II (D-5) sea-based missiles and sea-launched cruise missiles; and air-launched cruise missiles, bombs, and the new short-range attack missile--all carried by strategic bombers. Soviet hard-target weapons encompass the SS-18, SS-19, SS-24, SS-25 land-based missiles, sea-launched cruise missiles, and all bomber-carried nuclear weapons. The Soviet Union is not currently projected to acquire sea-launched ballistic missiles capable of destroying hard targets in the time period covered by this analysis (1986-1996). Although all of the above are classified as hard-target warheads, some systems are much more capable than others.

U.S. Warheads Surviving a Soviet First Strike. Because U.S. policy for deterrence relies on strategic nuclear forces capable of surviving an attack and retaliating, post-strike surviving weapons are an important measure of capability. Counts of post-strike weapons incorporate the capabilities of attacking Soviet forces and depend on specific assumptions about the nature of a Soviet attack and the U.S. response.

When measuring survivable warheads, it is important to characterize the assumptions underlying the Soviet attack scenario. An attack without warning--or "bolt-out-of-the-blue"--is considered by many to be the greater challenge to U.S. capabilities, because far fewer forces are maintained on constant "alert"-- that is, poised to react promptly to escape a Soviet attack. 2/ This kind of attack, however, is also widely considered to be the most unlikely form. An attack that was preceded by tensions and conflict elsewhere is considered more probable. In the latter case, a much higher fraction of U.S. bombers and submarines would be positioned for survivability and retaliation. In the general assumption in this analysis, ICBMs in silos would "ride-out" either type of attack since they cannot be dispersed for survivability. U.S. policy, however, neither assumes nor precludes launching these missiles on warning of a Soviet attack. And, in fact, the Soviet Union cannot be sure that the U.S. would ride out an attack on its ICBMs, especially in a case where a potential attack was anticipated.

Many other measures can also be used to characterize strategic capability: for example, the speed with which warheads can be delivered after an enemy attack--within minutes by land-based missiles or within hours by bombers--or the amount of "throwweight" (or payload capacity) of missiles. These measures are used as appropriate in this paper to identify specific characteristics of the strategic balance.

Although this analysis focuses on the presence or absence of arms control, the above measures are based on so-called "on-line" inventories of weapons since these indicate force capabilities that would be available in the event of nuclear war. 3/ Soviet Backfire bombers and U.S. FB-111

---

2. Only about a third of the bomber force and about half of the strategic submarine force is on alert in peacetime. Silo-based ICBMs are always on alert.

3. Arms control inventories generally count a delivery system as existing whether or not it is operational. Thus, for example, some retired bombers would count even though they would not realistically be flown. Also, for verifiability and conformity, arms control inventories assume each weapon carries the maximum number of warheads tested even though the operational system does not carry that many. Thus,

bombers are not counted as strategic bombers under SALT II counting rules, and are not included in the quantitative measures of capability. 4/

TODAY'S BALANCE

As Figure 1 shows, the United States and Soviet Union currently have similar numbers of on-line warheads, with the United States slightly ahead. The balance has not been static, however, even with arms limitations. Since 1982, under SALT II constraints, the United States and the USSR have each added about 2,000 warheads to their strategic nuclear arsenals.

While the numbers of total warheads are roughly even, the Soviet Union has about twice as many weapons capable of destroying hardened targets. The Soviet Union also has more than three times as much throw-weight in their land-based and sea-based ballistic missiles. Throwweight is a measure of the payload weight that missiles can carry, and may indicate the ability to increase either the size or the number of warheads on each missile. Both sides, in addition, have 100 percent of one key category of warheads--prompt response, hard-target warheads--on fixed, land-based missiles that are vulnerable to destruction in a nuclear attack. Some analysts fear that reliance on these warheads could be destabilizing in a crisis if either side decided that it would have to attack first to avoid losing these important forces.

The United States, on the other hand, may have some advantage in terms of survivability. The ability of U.S. forces to withstand a nuclear

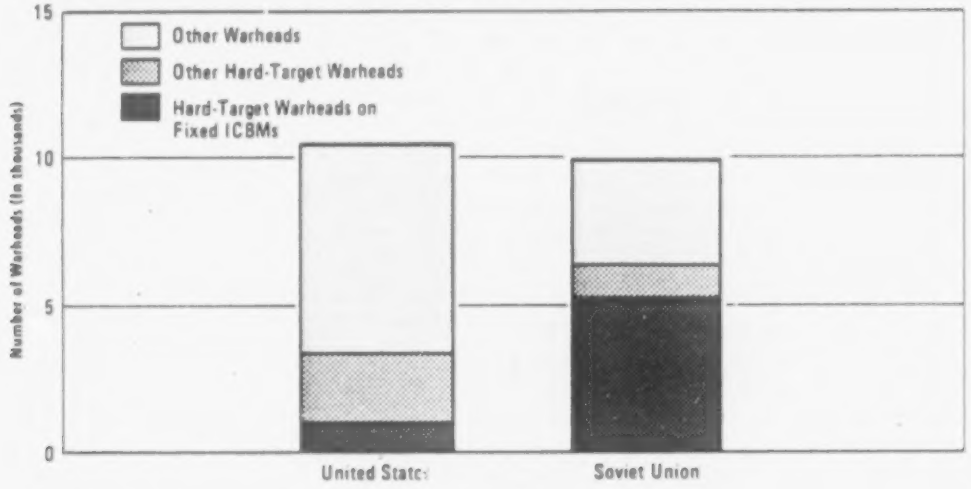
---

arms control inventories would be higher than the on-line inventories counted here.

On-line weapons are operational weapons not undergoing maintenance and repair. All silo-based ICBMs are considered to be on-line. About 10 percent of the U.S. bomber force is in the "maintenance pipeline" at any time, and U.S. submarine overhauls and repairs are generally predictable and scheduled. This analysis assumes about 20 percent of Soviet submarines are undergoing repair and overhaul at any time since a planned schedule cannot be constructed.

4. The U.S. has 56 FB-111s and these are planned to be transferred to the Tactical Air Force in the early 1990s. The Soviet Union has about 145 Backfire bombers assigned to the Long Range Air Force and continues to produce about 30 of these aircraft each year.

Figure 1.
Current U.S. and Soviet Strategic Forces



SOURCE: Congressional Budget Office.

attack and still retaliate is key to the U.S. strategy for deterring nuclear war. Today, the United States has a larger fraction of its total warheads on aircraft and submarines than does the Soviet Union, which emphasizes land-based missiles. Once aircraft on alert are airborne and submarines are at sea, both these forces--particularly the submarines--are thought likely to be able to survive a nuclear attack. Aircraft, however, depend more heavily on warning for survivability than do submarines.

SECTION II. PROJECTIONS UNDER SALT-TYPE CONSTRAINTS

How might the current overall balance of nuclear forces change over the next 10 years if SALT-type constraints remain in effect? There is likely to be a modest shift in the balance of warheads favoring the Soviet Union. The United States, however, probably would redress much of the current imbalance in hard-target warheads, and both sides seem likely to decrease the percentage of forces that are highly vulnerable to an initial nuclear strike.

DEFINING SALT-TYPE CONSTRAINTS

It is not realistic to assume that all the provisions of the SALT II treaty could remain in effect for the next 10 years. The last provisions of the unratified treaty expired in December 1985, and both countries have planned strategic force expansions that would go beyond its provisions. The Soviet Union is currently deploying a second new type of land-based intercontinental ballistic missile (ICBM) whereas SALT II allows only one new type. The United States is nearing full-scale development of its second type of new ICBM, the small ICBM (SICBM), whose deployment is also forbidden. The Administration has charged that several other Soviet actions have not been in conformance with the terms of SALT II and has listed these among the reasons for its latest policy of abandoning SALT altogether. Therefore, current practices are already inconsistent with a strict interpretation of SALT II.

Both sides have, however, generally been retiring current systems as new ones are deployed to stay within the launcher limits prescribed by SALT II. The treaty specifies limits on several successively broader categories of strategic launchers. The first restricts launchers of multiple warhead (MIRVed) land-based missiles to 820. The second constrains the total of land-based and sea-based launchers of multiple warhead missiles to 1,200. The third restrains the total of land-based and sea-based MIRVed launchers plus bombers carrying air-launched cruise missiles to 1,320. And the last limits all launchers--of either single or multiple warhead missiles plus bombers--to 2,250.

This analysis, then, defines "SALT-type constraints" as adherence to the SALT II launcher limits. To reflect reality, however, the paper specifies the overall launcher limit as 2,504 for the Soviet Union. Since SALT was never ratified by the United States, the USSR never reduced its overall launchers to the level designated by the treaty whereas U.S. forces were

within the limits. But the Soviet Union has been retiring current systems to stay within the limit of 2,504 launchers that characterized their forces around the completion of SALT negotiations. The United States would also exceed the 2,250 limit in the mid-1990s with deployment of the small ICBM, although it would never reach 2,504. Because of the discrepancy, this analysis assumes that the United States would take no compensatory action --like retirement of some Minuteman II missiles--to remain at the limit of 2,250.

PROJECTIONS

SALT-type restraints would permit planned modernization programs, by both the United States and the Soviet Union, which would continue to add substantial numbers of warheads through the mid-1990s.

Total Warheads

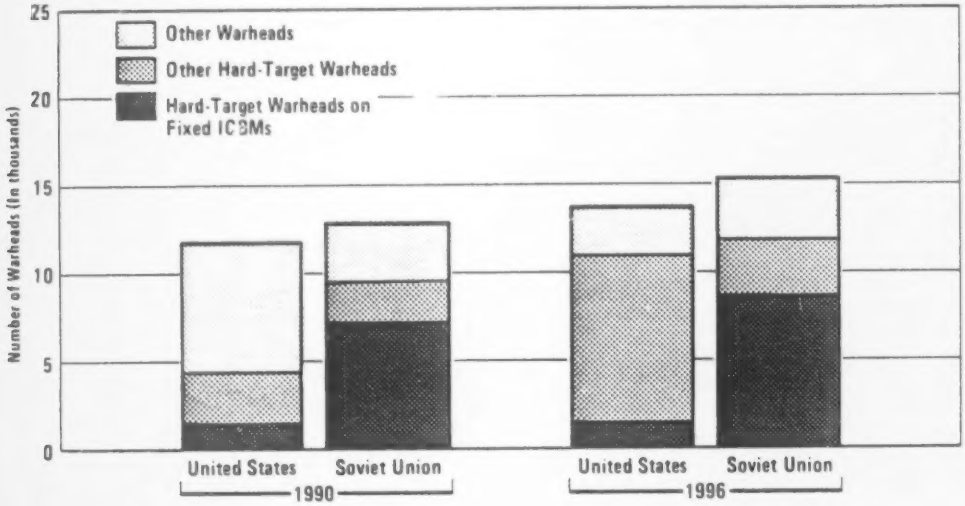
Total numbers of U.S. on-line warheads would increase from a 1986 level of about 10,500 to a peak of about 13,700 warheads by 1996--an increase of about 30 percent--and would remain roughly around 13,000 through the remainder of the century (with differences depending mostly on the number of submarines in overhaul in any year). Growth in numbers of warheads could occur despite SALT-type restraints because, in most cases, the United States is moving toward launchers that can carry more warheads. Warheads are not substantially constrained by the SALT II limits, which some consider a major weakness of the treaty since it has allowed expansion of nuclear forces through multiplying numbers of warheads on launchers.

Based on generally assumed estimates, the Soviet Union would also add more warheads under SALT-type constraints; in fact they would probably increase their supply by somewhat more than the United States, particularly because many of their current submarines and older ICBMs carry single warheads. Thus, by the mid-1990s, the USSR might have about 1,600 more warheads than the United States (see Figure 2).

Along with the increase in warheads, SALT-type restraints would allow a nearly complete modernization of both forces by the end of the century, although, in order to stay within SALT launcher limits, some older systems might have to be retired earlier than would otherwise occur. For the United States, Trident submarines with new, accurate Trident II (D-5) missiles would replace most of the existing Poseidon submarines by the mid-1990s. The strategic bomber fleet of B-1B and Advanced Technology Bombers (ATBs) would replace the current inventory of older B-52G model bombers.

Figure 2.

U.S. and Soviet Strategic Forces (With SALT-Type Constraints)



SOURCE: Congressional Budget Office.

And, while older Minuteman missiles would still probably comprise the majority of the ICBM force, the MX and new small ICBM would account for a significant fraction of that total.

The Soviet Union would be able to modernize its large SS-18 missiles and, by retiring less capable SS-17 and many SS-19 missiles, procure about 360 new MX-type SS-24 missiles, and acquire significant numbers of single-warhead SS-25 missiles. Each of these new missiles could be deployed in both mobile and silo-based modes. Because most of the Soviet's submarine-based force is currently composed of single-warhead missiles, under SALT-type restraints, they would be able to keep fewer modern submarines with multiple-warhead missiles. Overall numbers of submarine-based warheads, however, could increase modestly. The Soviet bomber force could also be modernized almost totally with Bear-H and Blackjack bombers by the mid-1990s.

Hard-Target Warheads

While the balance of total warheads would not change significantly, the balance of hard-target warheads could. U.S. hard-target warheads would increase from about 3,300 in 1986 to about 4,300 by 1990, a growth of about 30 percent, and up to about 10,100 by 1996, an increase of about 206 percent. This buildup in capability would occur largely because of the deployment of large numbers of cruise missiles on bombers and the deployment of Trident II missiles--the first hard-target ballistic missiles aboard submarines.

Growth in Soviet hard-target weapons could also be significant. Soviet hard-target warheads could increase from about 6,400 in 1986 to about 9,400 in 1990, a growth of about 47 percent, and to about 11,800 by 1996, or about 84 percent. Thus, the Soviet Union would retain its hard-target lead, but, by the mid-1990s its lead would be cut almost in half. If the United States chose to retire more Poseidon submarines and convert more bombers to carry cruise missiles, the discrepancy would be even smaller, but this growth in hard-target capability would come at the expense of the most survivable weapons in the U.S. inventory.

Other Measures

Under SALT-type restraints, the discrepancy in throwweight would decrease from 3-to-1 to 2.5-to-1 by 1996. It is unlikely to fall further unless the Soviet Union elected to retire its large land-based missiles (particularly SS-18s), which appears improbable. Both the United States and the USSR

would probably increase the number of hard-target warheads in fixed locations--those warheads most vulnerable in a nuclear attack. As a percentage of total hard-target warheads, however, these vulnerable ones would decrease in both countries, particularly in the United States.

SECTION III. PROJECTIONS WITHOUT SALT-TYPE CONSTRAINTS

Without SALT-type constraints or other arms control limits, both countries could consider a wider range of approaches to strategic nuclear forces.

SOVIET EXPANSION WITHOUT ARMS CONTROL LIMITS

Without arms control constraints, the Soviet Union need not alter the possible scenario discussed in the previous section. Indeed, the Administration feels that it would not change its plans substantially. The Administration has argued recently that the current rough balance of forces and the weakness of the Soviet economy would preclude a major buildup. Richard Perle, Assistant Secretary of Defense for International Security Policy, discussed this point when he appeared before the House Armed Services Committee: "I do not think it [forgoing SALT] is going to affect, in any fundamental way, either the size of the Soviet strategic forces or our own." 1/

On the other hand, the Soviet Union has developed considerable momentum in its force expansion plans. It now has two new ICBMs in the late stages of development or early deployment; two new strategic nuclear submarines and submarine-based ballistic missiles in the same status; two bombers in production and a new one projected to enter production shortly; and new cruise missiles being tested. Nor have the Soviets shied away from adding strategic systems in recent history. According to DoD's annual publication, *Soviet Military Power*, from 1976 to 1980 the Soviet Union produced 1,200 ICBMs, 58 submarines with 900 submarine-launched ballistic missiles (SLBMs), and 145 bombers.

Moreover, the CIA testified before a joint session of the Senate Armed Services and Senate Appropriations Committees: "While the Soviets would not necessarily expand their intercontinental attack forces beyond some 12,000 to 13,000 warheads in the absence of arms control constraints, they clearly have the capability for significant further expansion, to between 16,000 and 21,000 deployed warheads by the mid-1990s. . . . the upper figure is not a maximum effort but would require a substantially greater commitment of resources." In the same testimony, the CIA supplied a number of details on what types of forces the Soviets might increase during a build-

1. Testimony before the House Committee on Armed Services, June 5, 1986.

up. 2/ *Soviet Military Power* also estimates how Soviet forces might look in the 1990s.

It seems clear, therefore, that some Soviet buildup is possible in the absence of arms control agreements. The CBO has combined the two forecasts mentioned above to illustrate the implications of a buildup consistent with the upper end of the range of the CIA's public estimates (see Figure 3). (This is done solely to provide an upper bound for a wide range of possibilities. There is no intent to imply that this outcome is any more probable than the Administration's estimate of no change in Soviet strategy.) Growth to 21,000 warheads by the mid-1990s assumes that the Soviet Union would add about 10,000 warheads over 10 years. Since the USSR and the United States have each added over 2,000 warheads in the past three years under SALT restraints, the additional growth is clearly within the range of the possible. The postulated buildup is robust but, as the CIA noted, not the maximum effort the Soviet Union could undertake.

The specific weapons that the Soviets are assumed to add are also as consistent as possible with projections by the CIA and DoD. These specific assumptions are necessary to estimate how the balance of forces might change and to allow analysis of the effects on specific U.S. weapons, such as land-based missiles. Appendix A presents the assumed force expansion, which is summarized below.

Assumed Expansion

Under the assumed buildup, the number of Soviet warheads could increase from about 10,100 in 1986 to about 14,300 by 1990, a growth of about 42 percent, and to about 21,100 by 1996, or about 109 percent. Substantial growth would occur in all segments of the Soviet force, but the ICBMs would still contribute the majority of Soviet warheads.

Soviet hard-target warheads are projected to increase from about 6,400 in 1986 to about 10,400 by 1990, or about 63 percent, and to about 15,800 by 1996, or about 147 percent. The USSR would have about 1,000 more hard-target warheads by 1990 than if it followed SALT-type restraints, and about 4,000 more by 1996. Soviet throwweight would increase above

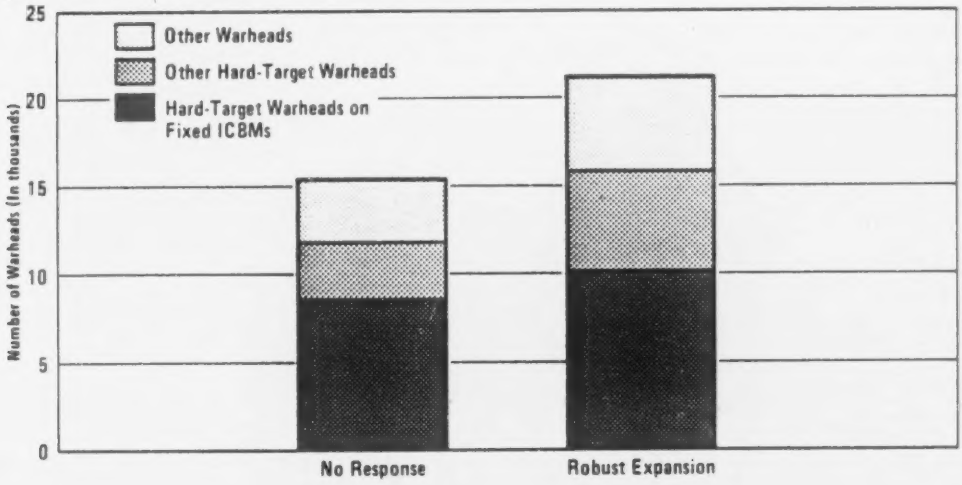
---

2. See testimony of Robert M. Gates and Lawrence K. Gershwin, before a joint session of the Subcommittee on Strategic and Theatre Nuclear Forces, Senate Armed Services Committee, and the Defense Subcommittee, Senate Committee on Appropriations, "Soviet Strategic Force Developments," June 26, 1985.

Figure 3.

Range of Possible Soviet Strategic Forces by 1996

(Without Arms Control Limits)



SOURCE Congressional Budget Office.

levels projected under SALT-type restraints--by about 7 percent by 1990 and by about 29 percent by 1996. The number of hard-target warheads in fixed sites would increase in absolute terms but decrease as a fraction of the force.

Clearly, this sort of expansion would add substantially to Soviet expenditures on strategic forces. This paper makes no attempt to estimate those costs, but their general magnitude could be suggested by numbers presented below to illustrate the possible costs of a U.S. effort to respond to a Soviet expansion.

U.S. RESPONSES

Even if the Soviet Union chose to expand its forces in the absence of SALT-type restraints or other arms control limits, the United States need not alter its plans substantially. In the face of an expansion like the one described above, but without Soviet technological breakthroughs, the United States would have enough forces likely to survive a Soviet attack to enable it to destroy the Soviet Union as a modern, industrial society. Investments the Administration has made and continues to make in strengthening the survivability of command and control links with these forces has also done much to assure their survivability and retaliatory capability. Some would contend that these capabilities achieve deterrence.

On the other hand, if the Soviets expanded their forces, the United States might decide to match that expansion, at least partially, in order to maintain the current rough numerical balance of nuclear forces. U.S. options would differ sharply between the near-term and the longer run.

Near-Term

Over the next few years, about the only thing the United States could readily do to expand its forces would be to forgo planned retirements of older strategic weapons and convert additional bombers to carry cruise missiles. By postponing the retirement of Poseidon submarines that would probably be required to meet SALT launcher limits and by converting more B-52s to carry cruise missiles, the United States could have about 2,000 more warheads by 1990. Because they would be on submarines and planes, many of these added warheads would be able to survive a Soviet attack. Costs for these measures would be modest, totaling about $1.1 billion for the period of fiscal years 1986 through 1991.

Over the next five years, the United States could also increase procurement of systems currently in production, but few new weapons would

actually enter the inventory by the end of five years. Systems currently in production include B-1B bombers, Trident submarines, and MX missiles. Additional B-1Bs could be procured and delivered around 1990, but the United States might not have enough missiles and bombs to arm them fully unless, for example, fewer B-52s were converted in order to provide weapons for the B-1Bs. If weapons were transferred to newer B-1Bs, the weapons might be somewhat more likely to survive and penetrate Soviet air defenses but the actual inventories would not increase. The cost of new B-1B bombers would, of course, depend on how many were purchased. Rockwell Corporation, producer of the B-1B, estimates added costs of 48 B-1Bs--the maximum produced annually thus far--at $10.8 billion. An extra Trident submarine equipped with Trident II missiles could be procured per year beginning in 1988, at an annual procurement cost of about $2.6 billion, but these would not begin to enter the force until about 1994. The additional 50 MX missiles the Administration plans to buy, but which have not been approved by the Congress, could be procured and put in Minuteman silos before 1990, adding a net increase of 350 hard-target warheads, but--unless they were launched before absorbing a Soviet attack--they would barely affect counts of survivable warheads. The cost for the additional MXs would be about $1.7 billion through 1990.

These U.S. near-term options, though limited, could largely offset the Soviet expansion in total numbers of warheads. 3/ If, for example, the United States chose to respond to the Soviet buildup described above only by retaining extra Poseidon submarines that would otherwise be retired to meet SALT constraints and modifying more B-52 bombers to carry cruise missiles, the warhead balance would shift, but not dramatically, by 1990 (see Figure 4). The U.S. could have about 13,600 warheads by 1990 compared with the USSR's 14,300. Since many of the additional warheads would not be capable against hardened targets, however, and with the assumed Soviet expansion of hard-target warheads, the discrepancy in numbers of hard-target warheads would be about the same as under the SALT-type restraints. Absolute numbers of Soviet hard-target warheads based in fixed sites would be somewhat greater than under SALT-type restraints, but they would become a somewhat smaller fraction of total hard-target capable warheads. U.S. fixed hard-target warheads, although constant in number, would also be a smaller fraction of total hard-target warheads. Throwweight discrepancies in the two forces would remain about the same in the near term. Survivable warheads for the U.S. in an attack with warning would

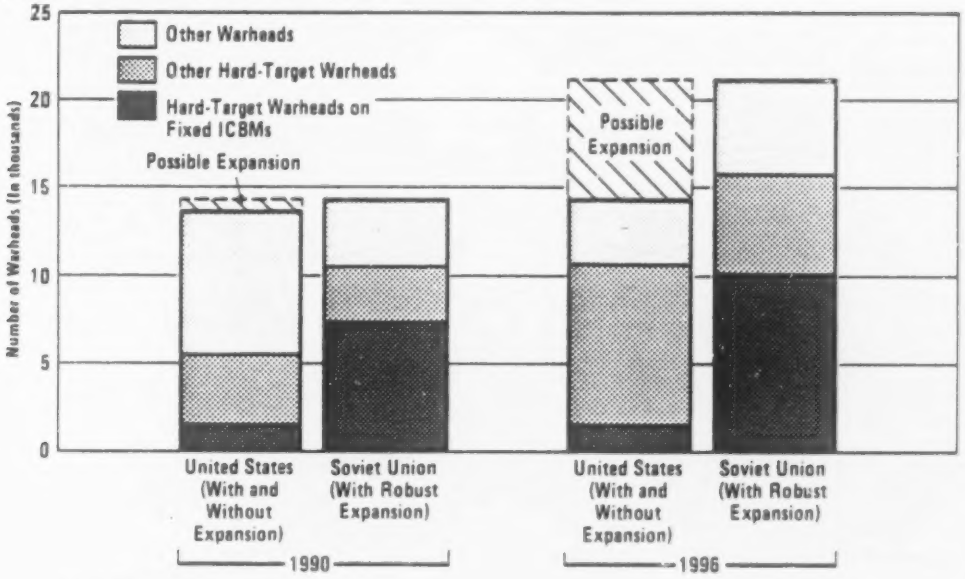
---

3. France and Great Britain are also modernizing and expanding their strategic forces. The Soviet Union would have to be concerned about their capability in the event of initiating nuclear war.

Figure 4.

U.S. and Soviet Strategic Forces, 1990 and 1996

(Without Arms Control Limits)



SOURCE: Congressional Budget Office.

total about 9,700 compared with about 8,100 under SALT because the added missiles would be on submarines and bombers. 4/

Longer-Term Options

Balance Without U.S. Force Expansion. By 1996, without any procurement of new systems by the United States--but retaining older systems and converting more bombers to carry cruise missiles--the warhead balance between the forces could shift dramatically (see Figure 4). With its assumed buildup, the USSR would have about 6,900 more warheads than the United States--21,100 compared with 14,200. The Soviet Union would also retain a substantial lead in hard-target forces. Specifically, they would have an advantage of about 5,000 hard-target weapons from 1990 through 1996.

As for vulnerable warheads that could be destabilizing in a crisis, the Soviet Union would have about 1,500 more fixed-site, hard-target warheads by 1996 than under SALT-type restraints, but these would continue to be a smaller proportion of overall hard-target warheads--64 percent compared with 72 percent. By this measure, in 1996, U.S. forces would not change much without SALT-type constraints. The discrepancy in throwweight between the two forces would grow from a ratio of 3-to-1 to 3.3-to-1 by 1996 with Soviet force expansion, whereas under SALT-type restraints it would fall to 2.5-to-1.

It is not clear that these imbalances would demand a U.S. response. By one important measure in terms of U.S. deterrent posture, the United States would continue to have large numbers of warheads able to survive a Soviet attack with warning and retaliate--about 9,800 without SALT compared with about 9,300 under SALT. (This finding assumes that actions would be taken to preserve survivability in the small ICBM and bomber forces, such as additional dispersal which could add to costs.) The same would be true for an attack without warning, although with slightly more than half the number of surviving weapons. Some analysts would argue that, since the United States would retain a robust capability in terms of warheads able to survive a first strike and retaliate, other imbalances would not seriously weaken deterrence. Others would contend, however, that preserving a balance of forces is a critical component of deterring war and preventing aggression.

---

4. The same would be true for a "bolt-out-of-the-blue" attack, but with about half the number of surviving warheads. Both the cases illustrated here assume that the silo-based ICBMs would ride-out the Soviet attack.

Possible Responses. To match the assumed Soviet force expansion fully would require a formidable enlargement of U.S. strategic forces. In addition to forces already planned, the United States would, for example, have to procure the following: about 867 MX missiles in Minuteman silos, or 36 Trident submarines with Trident II missiles, or 270 bombers each capable of carrying 28 weapons, or some combination of the above. To put these in context, adding 867 MX missiles would be about an 87 percent increase over the total number of existing land-based missiles; adding 36 Trident submarines or 270 bombers would roughly double the numbers of existing strategic submarines and bombers. If older forces other than submarines, such as B-52G bombers, could be retained through 1996, the number of new systems could be decreased. In addition to matching total Soviet warheads, any of these options would give the United States a lead in hard-target warheads since all of these systems have this capability. Increases in numbers of survivable warheads would depend on the option chosen.

The costs of such an enormous buildup of forces would depend on how the buildup was accomplished and how quickly. If there was to be a substantial buildup by the mid-1990s, it would almost certainly have to involve increases in a variety of forces, if for no reason other than industrial limits. Currently, for example, the United States has one shipyard building one Trident submarine a year. Considering the time required to build the ship--about six years--and the very limited number of U.S. shipyards that could build them, it would clearly be impossible to build and deploy anywhere near 36 additional Trident submarines by the mid-1990s. If, on the other hand, the United States chose to respond with a wider variety of systems or more gradually, then it would have more options.

A full analysis of costs would, thus, require detailed studies of timing and policy options as well as industrial capacity. One can grasp the general magnitude of potential costs, however, by focusing on two systems--Trident and MX--that probably form an upper and lower bound on costs. In fiscal year 1987 dollars, every Trident submarine with Trident II missiles costs about $2.6 billion. 5/ Thus, 36 would cost about $94 billion. If such a buildup were accomplished over 10 years, then added annual costs for acquisition alone would amount to about $9.4 billion, or about 38 percent of what DoD says it now spends on strategic forces.

Moreover, the Trident costs noted above are only for procurement of ships and missiles. These ships require special bases equipped to handle

---

5. This includes 28 Trident II missiles for each submarine--24 to fill the missile tubes and about four used over the life of the submarine to demonstrate and test the system, upon initial deployment and after overhauls.

nuclear weapons. Today there are two such bases, each equipped to take care of about 10 submarines. Since currently planned procurements will probably fill both, the United States would need to expand or build the equivalent of three or perhaps four more such bases. Each base costs roughly $2 billion (in current dollars) to build in addition to any costs to acquire land. Also, once it is built and based, the annual cost to man and operate a fleet of 36 such ships would total about $2.5 billion. Thus, the total cost to buy and operate 36 additional Trident submarines would be very large.

Costs for 867 MX missiles deployed in existing Minuteman silos would be less. Acquisition costs for the missiles would total about $27 billion. There would also be some costs to modify or refurbish existing silos and to operate the missiles, but these added costs should be modest since the silos already exist and Minuteman operating forces are in place. 6/ Although costs would be much less, installing 867 MX missiles in existing silos would place about 52 percent of U.S. hard-target warheads in fixed sites vulnerable to a Soviet nuclear attack. This disadvantage would have to be weighed against the lower costs.

While the MX approach would be the cheaper of the two responses, either U.S. approach would add greatly to this country's strategic costs as the Soviet expansion would to that country's. It should be emphasized again that such an expansion would not necessarily occur without arms control limits. The Soviet Union might not choose to enlarge its forces. If it did, the United States might choose not to match that expansion, but to rely instead on the substantial strategic forces it would already have to provide deterrence. The numbers given above serve only to illustrate what could happen if the USSR expanded its forces and if the United States chose to respond.

---

6. If the MX missiles were deployed in new superhard silos for some added survivability, then only 680 would need to be procured, to match the Soviet buildup, because they would not be replacing existing warheads. But total costs to buy 680 MX missiles and place them in new superhard silos would amount to about $100 billion. Operating costs would also increase substantially. If the silos were not superhardened, then costs would be about $85 billion.

SECTION IV. SURVIVABILITY OF U.S. FORCES WITH AND WITHOUT ARMS CONTROL LIMITS

The survivability of one of the three main segments of U.S. strategic forces --submarines--is unlikely to be affected greatly even if the Soviet Union were to accomplish the major strategic buildup described in the preceding section. Unless the USSR achieves a technological breakthrough--which could also occur under SALT-type restraints--U.S. submarines at sea should remain essentially invulnerable.

Nor are the extra Soviet warheads apt to threaten significantly U.S. bombers that are on alert and so are ready to take off within minutes of receipt of warning; the key to destroying alerted bombers is warheads that arrive quickly. Large numbers of quickly arriving submarine-launched warheads might allow the Soviet Union to barrage the air space around U.S. bases more effectively in an attempt to destroy bombers. But barraging space is a challenge even with a very large number of warheads. Also, measures such as additional dispersal could be taken to protect the bomber force. Analysis of potential effects of a Soviet buildup on the U.S. bomber force will be examined in more depth in CBO's forthcoming study. 1/

The survivability of U.S. land-based missiles, on the other hand, is likely to be affected by a Soviet expansion. These missiles include the existing Minuteman missiles, the 50 MX missiles whose deployment is currently planned, and the small intercontinental ballistic missile now being developed, as well as a further deployment of MX missiles now under consideration.

IMPLICATIONS FOR THE SICBM

The SICBM is so named because it will be relatively small--probably not more than 37,000 pounds compared with about 100 tons for the MX. It will probably carry only one or two warheads, rather than the 10 on the MX. The SICBM is also planned to be mobile--that is, some or all of the missiles will routinely roam an area randomly so that the USSR cannot target them at any one point. In periods of tension or on warning of attack, the missiles

1. U.S. submarines in port and bombers not on alert would almost certainly be destroyed whether or not the Soviet Union expanded its forces.

would be dispersed to even larger areas. Each SICBM would be housed in a special vehicle (or Hard Mobile Launcher) that can move about and provide protection in the event of nuclear attack. The vehicle would also serve as a launcher for the SICBM.

The SICBM is scheduled to enter full-scale development this fall. By that time, most decisions will have been made regarding its size, type of hard mobile launcher, and basing. As of this writing, however, these decisions are still under review. For purposes of illustration, this paper assumes that the "baseline" SICBM system consists of 500 single warhead mobile missiles deployed on four bases in the southwestern United States. Because costs associated with different SICBM options are still quite uncertain, the estimates presented here should be regarded as illustrations only.

SICBM and SALT-Type Restraints

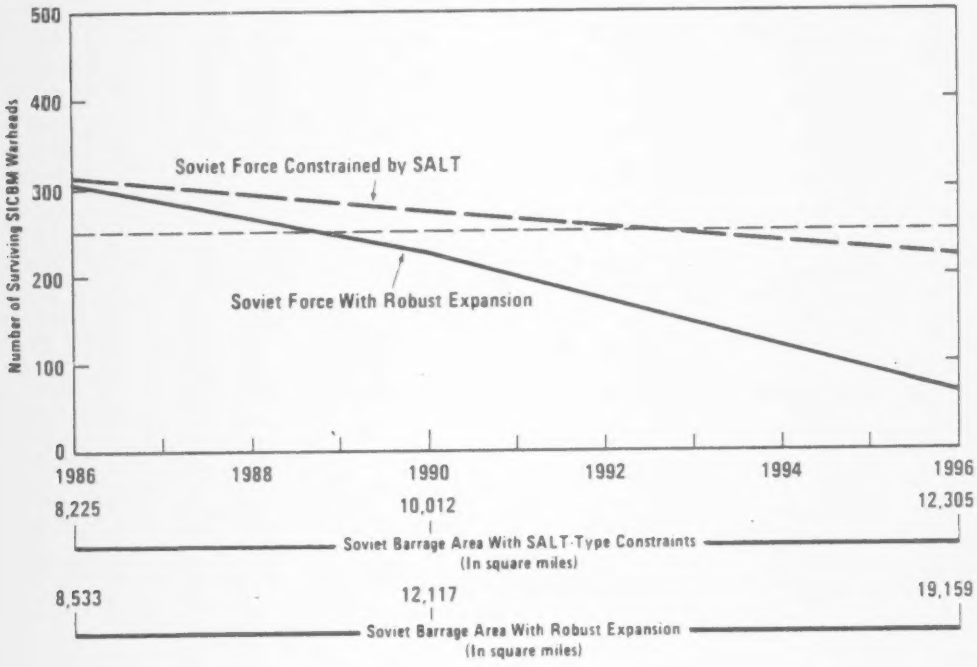
The Soviet Union would probably conduct a barrage attack against the SICBMs. Since it could not pinpoint the exact location of each SICBM, it would be forced to saturate the entire area to a heavy enough degree to destroy hardened vehicles carrying the missiles. As Figure 5 shows, in the early-to-mid 1990s, more than 50 percent, and by 1996 about 220, or 44 percent, of the baseline SICBM force should survive a Soviet barrage if its forces conform to SALT-type restraints. This estimate assumes that the Soviet Union would devote a substantial portion--about 36 percent of its warheads--to attacking the SICBMs (see Appendix B for details). In contrast, the USSR would be attacking a system that only accounts for about 4 percent of total U.S. warheads. The estimate also assumes a "bolt-out-of-the-blue" attack with no measures taken in advance to disperse the SICBMs. In the less than 30 minutes available after the USSR launched its ICBMs and the SICBM force received warning of the attack, it could be dispersed over such a wide area that the USSR would only have sufficient warheads to destroy a portion of it, thus allowing the fairly high percentage of survival. 2/ Also, the system is not very sensitive to technological improvements, an important factor because traditional arms controls do not effectively limit such changes. The only type of technological breakthrough that would allow the Soviet Union to destroy the system in its initial strike

2. The Soviet Union could choose to attack the system with shorter time-of-flight submarine-launched missiles to limit the dispersal time of the SICBMs, but since the SLBMs are not accurate enough to attack ICBM silos, the United States would have the option to launch these much more capable missiles after a confirmed attack on the U.S.--that is, after actual explosions on U.S. territory.

Figure 5.

SICBM Survivability

(Baseline Force: With SALT-Type Constraints Versus Expanded Soviet Force)



SOURCE: Congressional Budget Office.

would be the ability to detect and target individual SICBMs in the "intelligence cycle" time--that is, to be able to detect each SICBM's location and retarget the attacking ICBMs in flight. This technological advance would be extremely difficult and costly to achieve. 3/

SICBM and Soviet Force Expansion Without Arms Control Limits

As Figure 5 illustrates, far fewer of the baseline SICBM force would survive under the expanded Soviet threat that would be possible in the absence of arms limits should the Soviet Union choose to allocate a large percentage of its forces against the relatively small SICBM force. In the early-to-mid-1990s, fewer than 225 missiles, or 45 percent would survive, and that number would decrease to less than 65, or 13 percent, by 1996. These estimates assume that the Soviet Union would attack the SICBMs with the same types of systems as it would if constrained by SALT. But, without SALT-type restraints, the USSR could have so many additional warheads and greater throwweight that it could effectively barrage SICBM fields and still have many warheads left over for other purposes (see Appendix B for detailed assumptions).

What would have to be done to maintain the SICBM force's survivability? There are essentially three options to maintain a given number of surviving warheads in the SICBM force if the Soviet threat were to expand (see Figure 6):

- Buy more SICBMs;
- Increase the number of warheads on each SICBM so that, for each one that survives, more warheads would also survive; and
- Increase the size or number of basing areas to allow the SICBM force more room to disperse. 4/

---

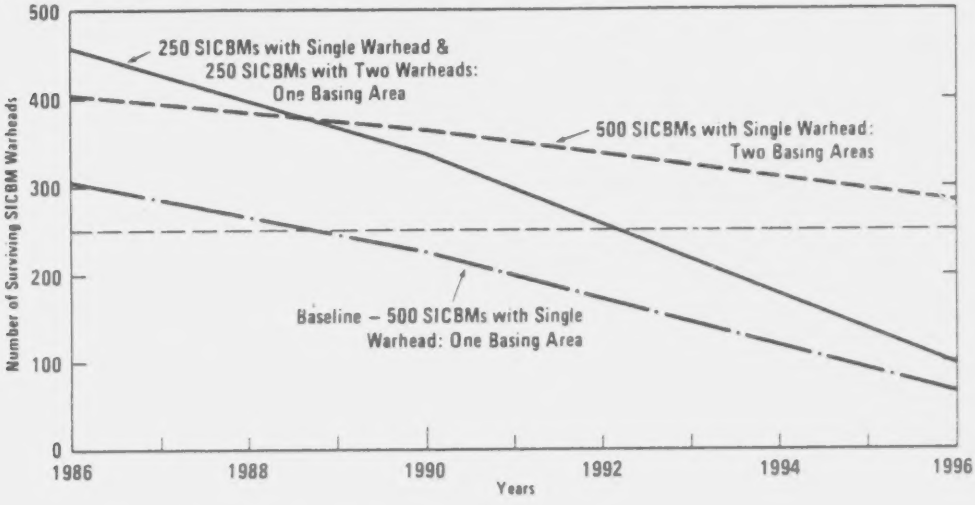
3. If the United States chose to retain its small ICBM as a reserve force, the Soviet Union might use penetrating bombers to locate and target individual SICBMs in follow-on attacks. In such a case, however, the SICBM--if lightweight and mobile enough--could be dispersed virtually over the entire continental United States.

4. A fourth option would be to harden further the mobile launcher. At hardness much beyond the baseline level of 30 pounds per square inch (psi), however, costs go up greatly. It is very difficult to harden the electronic components beyond to this degree.

Figure 6.

Survivability of U.S. Small ICBMs, 1986, 1990, and 1996

(Soviet Forces Unconstrained by Arms Control Limits)



SOURCE Congressional Budget Office

TABLE 1. ADDED LIFE-CYCLE COSTS TO MAINTAIN AT LEAST 250 SURVIVING SICBMs UNDER THREE ALTERNATIVES (In billions of 1987 dollars)

	Costs	
Buy 1,436 More SICBMs, All at Southwestern Basing a/	30.0	Acquisition
	43.0	Operating and Support (O&S)
Total	73.0	
Buy 593 More Two-Warhead SICBMs, All at Southwestern Basing	12.0	Acquisition
	18.0	O&S
Total	30.0	
Buy More Area for Dispersal-- 250 at Southwestern Basing and 250 at Minuteman Basing	3.4	Military Construction
	-1.4	O&S (Savings)
Total	2.0	

a. Baseline system life-cycle costs provided by DoD amount to about $45 billion for the 30,000 pound missile; costs may be slightly higher for the 37,000 pound missile.

Increasing the size of the basing area would be the least costly approach (see Table 1). To maintain 250 surviving warheads through 1996 by buying 1,436 additional SICBMs would add about $73 billion, or about 162 percent, to the life-cycle cost of the system. Maintaining 250 survivors by increasing from one to two warheads per missile on half the missiles, plus buying 593 extra two-warhead missiles, would add about $30 billion, or about 67 percent, to life-cycle costs. 5/ 6/ Finally, expanding the basing areas

5. Because mobility is so important to the system, CBO assumes that the missile will be no larger than 37,000 pounds, the weight limit recently specified in the press release describing the House Armed Services authorization bill. According to the Air Force, it is possible to put two warheads on a missile this size without significantly reducing the range of the missile. Tests are currently being conducted on the mobility of a launcher large enough to carry a 52,000 pound missile that could carry three warheads.

6. This option assumes that the missile is initially procured with a single warhead, but that midway through production of the initial 500 mis-

for the SICBM would add only about $2 billion, or about 4 percent. 7/ This approach assumes that, rather than basing all 500 SICBMs at southwestern bases as the baseline assumes, 250 SICBMs would be based at the southwestern bases and 250 in the areas surrounding three existing Minuteman missile wings in the northcentral United States. Thus, the area available for dispersal of the SICBMs would be roughly doubled, increasing their survivability.

The specific examples provided above illustrate a more general point. The Soviet Union would have to use many more warheads to destroy the SICBMs than the SICBMs carry. Thus, the price to attack the SICBM system would not only be high under SALT restraints, but, with an expanded dispersal area, could be even higher in spite of a much larger Soviet threat (see Figure 7). Thus, the SICBM force should retain inherent flexibility to respond to an expanded Soviet threat in contrast with multiple-warhead missiles which are based in fixed silos. Multiple warheads pay an additional premium to the attacker since, with one or two warheads, the attacker would have a high probability of destroying several times the number of warheads used in the attack.

EFFECTS ON OTHER LAND-BASED MISSILES

Indeed, because the silo-based missiles would probably be targeted in any case, an expansion of Soviet forces should have little effect on these missiles, including existing Minuteman missiles and the 50 MX missiles now being deployed to replace some of the Minuteman. Thus, their survivability depends on U.S. policy. If the United States chose to "ride out" a Soviet

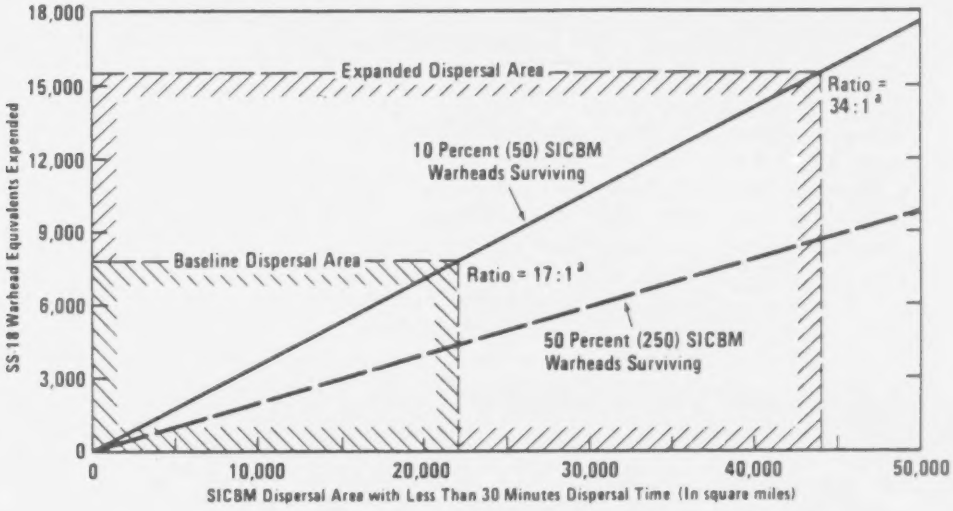
---

siles, a two-warhead version would be incorporated through a block change. Thus, there would be no delay in initial production, and the initial 500 missiles would carry 750 total warheads. This method would also preserve the targeting flexibility provided by having some single-warhead missiles and maintain the option of having penetration aids on that half of the missile force having single warheads. None of these options include Department of Energy costs for the warheads. Thus, costs for this option do not include costs of the second warhead, which would be modest under this block change approach.

7. This figure is an upper bound that assumes the same military construction costs at each site as if the entire 500 missiles were based there. In fact, if the basing were split, such infrastructure costs might be lower.

Figure 7.

Soviet Warheads Needed to Destroy 50 Percent and 90 Percent of U.S. Baseline SICBM Force, As a Function of Dispersal Area



SOURCE: Congressional Budget Office.

[a] Ratio of Soviet attacking warheads to U.S. SICBMs destroyed.

attack that occurred in 1996, probably less than 1 percent would survive, even with SALT-type restraints because of improving Soviet missile accuracy. Thus, an expansion of Soviet forces would have little effect. On the other hand, all land-based missiles could survive, regardless of the size of the Soviet threat, if the United States chose to "launch on warning" of a Soviet attack. 8/

The Department of Defense is considering requesting a further deployment of 50 MX missiles that would be installed in a basing mode yet to be determined. The options reportedly include a so-called "patterned array," in which superhardened silos--difficult to attack in themselves--would be closely spaced so that atmospheric nuclear effects from an attack on one silo would impede attacks on other silos. Other options reportedly would use variations of deceptive basing in combination with hardened launch sites. For example, each MX missile could be covertly shuttled among many superhardened silos or tunnels; if successful, such deception would raise the cost of destroying the system. Since none of these proposals is firm, detailed analysis of their survivability would be premature. It is possible, however, to assess in general terms their strengths and weaknesses with and without arms constraints.

With arms control, the survivability of deceptive basing modes (in conjunction with hardening) should be predictable, assuming the deception works. The system would have to be large enough to require more attacking warheads than the Soviet Union would probably be willing to devote. Survivability of missiles in a patterned array would be more difficult to predict, but is not likely to be greatly affected by current forms of arms control. Destruction of missiles in a patterned array would likely require technological improvements, such as earth penetrating warheads and precise attack timing, and changes to Soviet forces, such as fewer but larger warheads on some missiles. These improvements would take time to achieve but are nearly impossible to control with arms limits.

Without arms control, and in the face of an expanded threat, deceptive basing modes are likely to suffer more than patterned arrays, as their finite

---

8. There is an important distinction between "launch on warning" and "launch under attack." In the first case, the United States would be relying on information from satellite and other command and control sensors that an attack was underway. Thus, there is always some risk of erroneous information, although the U.S. depends on independent confirmation from at least two distinct sensor systems. "Launch under attack" would occur after Soviet warheads have actually exploded over U.S. territory and might allow the United States to launch its ICBMs before their being attacked (see section below on Synergism).

aimpoints can be more easily overwhelmed by a larger attacking force. As noted above, survivability of warheads in a patterned array would probably not suffer significantly merely from an expanded threat size. 9/

SYNERGISM

None of the results about the survivability of SICBM or alternative basing modes necessarily implies, however, that one single method is clearly superior, with or without arms limits. ICBMs based in modes that would require very different types of attack--such as mobile SICBMs and patterned array for MX--might provide some synergistic survivability because the Soviet Union could not optimize its forces to attack both systems and would have either to make trade-offs in its forces or invest proportionally more to attack both systems successfully.

This synergism also functions among other segments of the triad. For instance, the bombers and land-based ICBMs are, together, more survivable than either segment would be alone. Once bombers on alert are airborne for a few minutes, they are extremely difficult to attack. If the Soviet Union attempted a quick attack with missiles from submarines near the U.S. coast, it would provide about 15 minutes time in which the U.S.'s formidable, silo-based ICBM force could be launched under confirmed attack but before ICBMs from the USSR could arrive to attack them. Conversely, if the Soviet Union waited until its ICBMs arrived to begin barraging the bombers, most of the planes would survive (although they would still have to face USSR air defenses). The synergism between the new, mobile small ICBM system and the larger silo-based ICBMs would be similar, since the dispersal area of the SICBM force increases rapidly with time. Furthermore, the USSR might have to make some trade-offs in barraging bombers and the SICBMs, increasing the survivability of one or the other.

---

9. If the USSR relied on current technology to attack a patterned array, then an expanded threat might do more to jeopardize the array. With current technology, the USSR would have to use warheads exploded above the array to "pin down" the MX missiles so they could not be launched in between direct attacks on the silos. The USSR would have to wait for nuclear effects, like debris, to subside in between attacks on the silos so that incoming warheads would not be affected. Additional warheads might be useful to the Soviet Union in conducting a "pin-down" since this type of attack requires many warheads. But technological improvements like earth-penetrator warheads would probably provide a more effective means of attacking a patterned array than would a pin-down attack.

APPENDIXES

APPENDIX A. ILLUSTRATIVE SOVIET BALLISTIC MISSILE FORCES WITH SALT-TYPE CONSTRAINTS AND WITH ROBUST EXPANSION

TABLE A-1. ILLUSTRATIVE SOVIET BALLISTIC MISSILE FORCES WITH SALT-TYPE CONSTRAINTS (By year, in number of missiles) a/

System	1986	1990	1996
SS-11	437	270	0
SS-13	60	0	0
SS-17	127	0	0
SS-24 (Silo-based)	0	150	360
SS-18	308	158	0
SS-18 (Follow-on)	0	150	308
SS-19	360	312	102
SS-24 (Mobile)	25	50	50
SS-25 (Single-warhead)	75	252	756
SS-25 (MIRVed)	0	0	0
SS-N-6 (Y-I)	304	256	96
SS-N-8 (D-I, D-II)	292	292	232
SS-N-18 (D-III)	224	160	48
SS-N-23 (D-IV, D-V)	32	64	128
S-N-20 (Typhoon)	80	160	200

a. The illustrative force is based on the following assumptions:

- The Soviet Union would continue to accord primary importance to its ICBM force.
- It would modernize its large-throwweight SS-18s with a more accurate, 14-warhead version. This would be in violation of a strict interpretation of SALT II, but would not be in violation of the launcher limits.
- It would retire SS-17s and many SS-19s in favor of the new generation 10-warhead SS-24.
- The Soviet Union would deploy large numbers of SS-25 single-warhead missiles that count only against the launcher limit of 2,504 for SALT II, and retire older single-warhead ICBMs. It would not deploy a multiple-warhead version of the SS-25 under SALT-type constraints.
- It would proceed with modernization of its sea-based forces, but would not backfit Delta III submarines with new SS-N-23 missiles since many of the Delta IIIs would be retired under SALT II

launcher limits. Overall numbers of sea-based launchers would decrease, but overall numbers of sea-based warheads would increase.

- It would modernize and slightly expand its long-range bomber force; 24 old Bear bombers, 80 Bear-H bombers, and 120 Blackjack bombers would enter the force by 1996.

TABLE A-2. ILLUSTRATIVE SOVIET BALLISTIC MISSILE FORCES WITH ROBUST EXPANSION
(By year, in numbers of missiles) a/

System	1986	1990	1996
SS-11	520	270	0
SS-13	60	0	0
SS-17	150	0	0
SS-24 (Silo based)	0	150	360
SS-18	308	158	0
SS-18 (Follow-on)	0	150	308
SS-19	360	360	360
SS-24 (Mobile)	25	125	200
SS-25	75	252	252
SS-25 (MIRVed)	0	0	315
SS-N-6 (Y-I)	304	240	144
S-N-8 (D-I, D-II)	292	268	232
SS-N-18 (D-III)	224	160	64
SS-N-23 (D-IV, D-V, D-III Backfit)	32	128	304
SS-N-20 (Typhoon)	80	160	240

a. The illustrative force is based on the following assumptions:

- The Soviet Union retains some systems in 1986 that would otherwise be retired for SALT II compliance.
- The Soviet Union would have about 21,000 warheads by 1996 according to CIA projections.
- The force structure is as consistent as possible with the data provided in CIA and DoD projections cited in the report.
- Silo-based, 10-warhead SS-24s would replace SS-17s and some SS-19s in their upgraded silos; the portion of the SS-19 force that is replaced by SS-24s would be moved to older, less-hard SS-11 silos.
- The Soviet Union would modernize its large-throwweight SS-18s with a more accurate, 14-warhead version.
- It would deploy a three-warhead version of the SS-25 in the 1990s.
- It would proceed with modernization of its sea-based forces, but maintain a constant number of submarines--62.
- It would backfit Delta III submarines with the new SS-N-23 missile beginning in the late-1980s.

- It would modernize and modestly expand the long-range bomber forces; 24 old Bear bombers, 100 Bear-H bombers and 120 Blackjack bombers would enter the force by 1996.
- Production rates consistent with these force projections would include:
  - 1.5 submarines a year
  - less than 150 ICBMs a year
  - 16-20 long-range bombers a year
- Soviet warhead force mix by 1996 would include about:
  - 48 percent on silo-based ICBMs
  - 15 percent on mobile ICBMs
  - 23 percent on submarines
  - 14 percent on bombers

APPENDIX B. ASSUMPTIONS UNDERLYING SOVIET FORCES USED TO ATTACK THE SICBM SYSTEM

The text of the report analyzes the survivability of the small intercontinental ballistic missiles (SICBMs) in the event of a strong Soviet attack against the system. 1/ A key feature of the SICBM system is the tremendous expenditure of Soviet resources that would be required to attack the SICBMs in exchange for a relatively small payoff. For example, this analysis assumes that by 1996 in the case of an expanded Soviet force, the Soviet Union would dedicate about 40 percent of its warheads--about 8,500--or about 51 percent of its throwweight to attacking small ICBMs. In the assumed baseline SICBM configuration, this attack would destroy about 87 percent of the SICBMs. This number, however, represents only 435 warheads, or about 3 percent of total U.S. warheads. If the SICBM system were divided between two basing areas, roughly doubling the dispersal area, then the USSR would only destroy about 218 SICBMs, or about 2 percent of U.S. warheads, and about 282 SICBMs would survive. Thus, the Soviet Union might well not consider this type of attack the best use of its resources. 2/

The following sections present the assumptions underlying the Soviet forces that would be used to attack the SICBM system. These assumptions are consistent both for illustrations with SALT-type restraints and with a robust expansion of the Soviet strategic force, although they lead to larger numbers of attacking warheads in the latter case.

Assumptions Underlying Soviet Forces Withheld from SICBM Attack

- The Soviet Union would reserve 3,000 of its best hard-target warheads for counterforce targets like U.S. ICBM silos, hardened command and control nodes, and so forth. (The United States currently has 1,000 operational ICBM silos.) 3/ If additional MX

---

1. For purposes of illustration, it shows attack scenarios in each of the years considered in the report, including 1986, even through the system will not begin to be deployed until 1992.

2. The SICBM dispersal area assumed in this analysis does not account for topographical areas into which the SICBM could not disperse, and which the Soviets could avoid attacking.

3. See, for example, William Dougherty, and others, "The Consequences of 'Limited' Nuclear Attacks on the United States," International

missiles were deployed in a hardened basing mode, like "patterned array," the Soviet requirement might increase, and might decrease the number of warheads available to attack the SICBM system.

- As new generation SS-24 missiles are deployed, this counterforce requirement would be split between SS-18 and SS-24 missiles for additional reliability as a hedge against the failure of one system.

- The USSR would retain its submarine-launched ballistic missile (SLBM) force for targets such as other command and control sites, bomber bases, submarine bases, and so forth, and for its reserve force.

- It would retain SS-25 missiles for the reserve force and for any single-warhead targeting requirements.

Assumptions Underlying Soviet Forces Used for SICBM Attack

- The Soviet Union would use its remaining SS-18 and SS-24 missiles.

- It would use all SS-17s until these are retired.

- It would use all SS-19s that have not been retired.

This illustrative attack force assumes no SLBMs would be used against SICBMs. If the Soviet Union chose to use its SLBMs to attack U.S. bombers and SICBMs quickly, before they could disperse very far, then it might make trade-offs in the allocation of this force between bombers and SICBMs. In such a case, however, the USSR would face the high probability that the United States would launch its silo-based ICBM force after confirmed attack and before Soviet ICBMs could arrive to attack them. 4/

Security, Spring 1986 (vol. 10, no. 4), p. 30. This estimate is also about the equivalent of the Soviet Union's current, most-capable SS-18 missile force.

4. Soviet SLBMs projected in this time frame would be ineffective against the silo-based ICBMs, and using SLBMs to "pindown" the silo-based ICBMs until Soviet ICBMs arrive would, at a minimum, seriously deplete these attacking forces and, thus, their capability against the bombers and SICBMs.